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(71) Applicants *(for all designated States except US):* DE LA RUE SYSTEMS LIMITED [GB/GB]; De La Rue House, 3/5 Burlington Gardens, London W1A 1DL (GB). THE QUANTUM FUND LIMITED [GB/GB]; 16 Buccleuch Place, Edinburgh EH8 9LN (GB).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)* : BROTHERSTON, Colin, Peter [GB/GB]; 7 Helston Drive, Emsworth, Hampshire PO10 7TP (GB). DENYER, Peter, Brian [GB/GB]; 91 Collinton Road, Edinburgh EH10 5DF (GB).

(74) Agent: GILL JENNINGS & EVERY; 53-64 Chancery Lane, London WC2A 1HN (GB).

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(54) Title: IMPROVEMENTS RELATING TO VERIFICATION OR AUTHENTICATION PROCESSES

(57) Abstract

A method of updating reference biometric data characteristic of an individual for use in a verification or authentication process in which process the relationship between the currently measured biometric data and the reference biometric data is determined. The method comprises monitoring the acceptability of the relationship determined during a number of verification of authentication processes; and if a number N (e.g. 3) of the relationships over a number M (e.g. 8) of verification or authentication processes is unacceptable, updating the reference biometric data with more recently obtained biometric data.

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IMPROVEMENTS RELATING TO VERIFICATION
OR AUTHENTICATION PROCESSES

The invention relates to a method of updating
reference biometric data characteristic of an individual
for use in a verification or authentication process in
which process the relationship between currently measured
biometric data and the reference biometric data is
determined.

It is becoming common to make use of biometric data to
verify or authenticate an individual prior to permitting
that individual to take part in a transfer of value
transaction, gain access to a building and the like.
Biometric data defines one or more physical or behavioural
characteristics of the individual and includes signature,
voice and fingerprint data and the like. In a conventional
verification or authentication process, an individual is
initially enrolled during which reference biometric data is
obtained (possibly by averaging a number of samples) and
then during subsequent verification or authentication
processes, this reference data is compared with currently
measured biometric data. For example, a value may be
generated defining the difference between two sets of data
and this value is then compared with a threshold. If the
value is greater than the threshold then the individual is
not verified or authenticated but otherwise authentication
is achieved.

One of the problems with the conventional system is
the manner in which initial enrolment is performed.
Generally, a number of sets of biometric data have to be
supplied which are then processed to form a final reference
data set.

Furthermore it has been the practice in a number of
identification systems to continually update the reference
biometric data whenever a successful identification occurs.
Thus, as soon as an individual passes the required
verification or authentication requirements, the reference

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biometric data is replaced by the currently measured biometric data.

In accordance with the present invention, a method of updating reference biometric data characteristic of an individual for use in a verification or authentication process in which process the relationship between the currently measured biometric data and the reference biometric data is determined comprises monitoring the acceptibility of the relationship determined during a number of verification or authentication processes; and if a number N of the relationships over a number M of verification or authentication processes is unacceptable, updating the reference biometric data with more recently obtained biometric data.

We have devised a method which allows a very simple enrolment process, generally the supply of a single set of biometric data, but which updates that reference data depending upon the performance of the individual during subsequent verification or authentication processes. It should be noted, in contrast, that previous updating techniques have not monitored the performance of the user but have simply replaced the reference data on every occasion of a successful identification. Our method also reduces the need for formal reenrolment in the case of poor performance.

A problem with biometric characteristics is that these can vary due to damage, variations in temperature and variations in the manner in which the parameter is presented by the individual. Consequently, verification or authentication processes generally define a tolerance band within which a current biometric measure must fall. This tolerance band is defined by the initial reference data. A balance has to be drawn, however, between making

the band too narrow so as to produce a number of false acceptances and making the band broad enough to reduce the number of false rejections. This balance can vary depending upon the sensitivity of the activity to which the individual is to be permitted access.

A problem with these conventional updating methods is that where currently measured or bid biometric data fall close to the limit of a tolerance band then this will be used to update the reference biometric data thus running the risk that the quality of this reference data will be degraded by being over written by marginal bid data.

Preferably therefore in order to overcome this problem, the more recently obtained biometric data which is used to update the reference biometric data is selected from biometric data which satisfies predetermined conditions defining a better degree of acceptability than is essential to pass the verification or authentication process.

For example, where the relationship used in the verification or authentication process is a tolerance band within which the currently meausured biometric data must fall, the predetermined conditions may define a narrower tolerance band.

In other examples, in which a comparison score is generated defining the relationship between the currently measured and reference biometric data, only currently measured biometric data which has a score exceeding a threshold is used to update the reference biometric data.

In further examples, the condition of the currently measured biometric data is monitored, the predetermined conditions defining a condition of the currently measured biometric data exceeding a threshold. For example, in the case of fingerprint verification, an image of the fingerprint is formed by contact between the finger and a

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platen.   The platen is typically made of a polymer
material to improve the optical contact of the skin.   The
brightness of the image is caused by a good (high area)
optical contact.   In this system - contact causes
5   brightness.   Poor contact may occur due to

   1)   Insufficient application pressure.
   2)   Dry skin.

The optical sensor in the unit (CCD imager) recognises
the brightness as a voltage output.   This output is
10   digitised and filtered to produce a digital image.

   If the brightness is low - the image becomes degraded
and starts to be affected by noise - eg. background
illumination effects which are always present in the
system.

15   On a wider view - ie. applying re-enrolment to other
non-optical biometric systems - brightness is synonymous
with any sensor output - eg. sound, temperature.

   Typically, the most recently obtained measured
biometric data which satisfies the predetermined conditions
20   will be used to update the reference biometric data.

   In the preferred example, N is at least 3 and M is 8.

   In some cases, the user's performance can be so poor
that automatic updating of the reference data is
insufficient to significantly improve his performance.
25   Preferably therefore the method further comprises
monitoring the performance of the user and providing an
indication that reenrolment is advisable if the
performance of the updating method satisfies predetermined
conditions. These predetermined conditions may comprise the
30   detection of at least P consecutive unacceptable
relationships, or the performance of at least Q updating
steps within R performances of the verification or
authentication process.

   In the preferred examples, P is 4, Q is 3 and R is 32.
35

   An example of a fingerprint verification process
incorporating a method according to the invention will now

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be described with reference to the accompaning drawing which is a flow diagram of the method.

In this description it will be assumed that a conventional fingerprint detection apparatus is used for example of the type described in PCT/GB90·/01270 the disclosure of which is incorporated herein by reference. It should be noted, however, that the present invention is applicable to all forms of biometric verification including signature, voice and the like.

Before the verification or authentication process can be used, a formal enrolment process is undergone. In this enrolment process, the user is requested to give a single fingerprint in the same fashion as for a normal or bid use. This is particularly attractive to the user since it minimises the time involved in enrolling but it has to be recognised that the enrolled image is significantly imperfect for approximately 20% of the user population. The present invention overcomes this problem by monitoring the performance of each user.

During a normal use, the user presents his finger to enable bid biometric data to be determined (step 1). This determination is performed in a conventional manner to generate a value or set of values which are then compared (step 2) with a corresponding reference set which initially has been obtained during the enrolment process. This comparison may involve determing the difference between two single values or, in the case of sets of values, dermining the Euclidean distance between the sets. In another approach, the reference data can be used to set a tolerance band around the or each reference value and it is determined whether the corresponding bid values each fall within their respective tolerance bands.

Whether or not the comparison is successful, an unsuccessful bid count N is reviewed. This value N represents the number of unsuccessful bids in the last eight attempts. Thus, the last eight attempts including the most recent are reviewed and the count N adjusted to

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indicate the number of unsuccessful attempts in those last eight (step 3).

    If the latest bid is unsuccessful, for example because one or more of the bid values falls outside corresponding tolerance bands or the difference between the bid and reference data exceeds a predetermined threshold then the verification or authentication process may end although in some cases processing may return to step 1 to allow a further attempt to be processed. A limit may be set on the number of repeats permitted in a certain time interval.

    If the bid is successful then verification will be indicated (step 4) allowing the user to perform the secure process to which he has gained access.

    In addition, in the case of a successful bid, the count N is reviewed to see whether it is equal to or exceeds 3. If it is less than 3 then the process ends but if it is equal to or greater than 3 then the tolerance reference data is replaced with the most recently obtained bid data (step 5).

    In certain circumstances, a user's performance may be so poor that this process will not be sufficient by itself to improve the performance. This may be detected if for example there are four or more consecutive unsuccessful bids or the reference data is replaced three or more times within a history of 32 attempts. In these cases, the user can be recommended to reenrol under supervision using a different finger. The recommendation contains the form of an audible or visual warning, repeated at every bid.
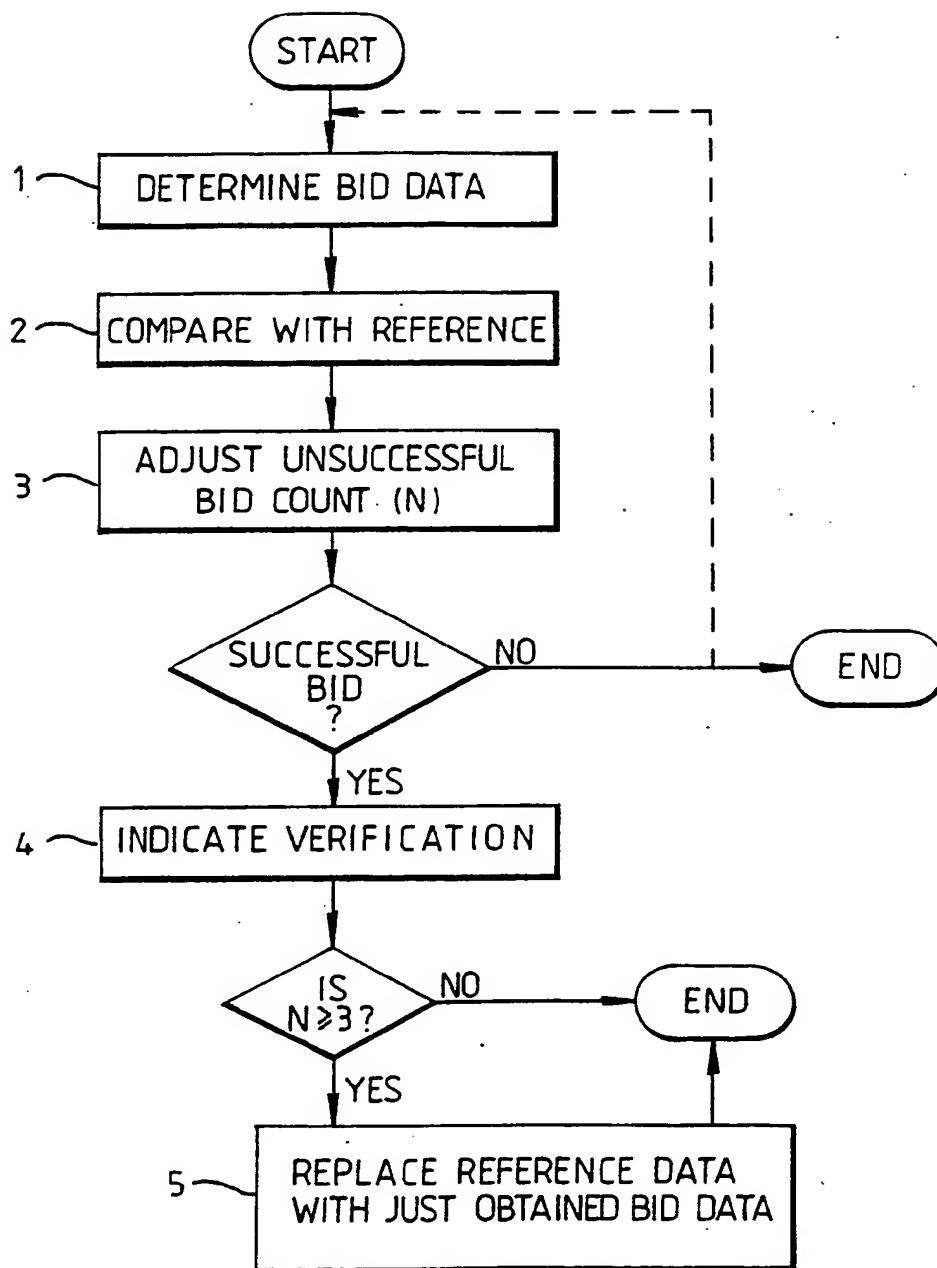
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CLAIMS

1.   A method of updating reference biometric data characteristic of an individual for use in a verification or authentication process in which process the relationship between the currently measured biometric data and the reference biometic data is determined, the method comprising monitoring the acceptibility of the relationship determined during a number of verification or authentication processes; and if a number N of the relationships over a number M of verification or authentication processes is unacceptable, updating the reference biometric data with more recently obtained biometric data.

2.   A method according to claim 1, wherein the more recently obtained biometric data which is used to update the reference biometric data is selected from biometric data which satisfies predetermined conditions defining a better degree of acceptability than is essential to pass the verification or authentication process.

3.   A method according to claim 2, wherein the most recently obtained measured biometric data which satisfies the predetermined conditions will be used to update the reference biometric data.

4.   A method according to any of the preceeding claims, wherein N is at least 3 and M is 8.

5.   A method according to any of the preceeding claims, further comprising monitoring the performance of the user and providing an indication that reenrolment is advisable if the performance of the updating method satisfies predetermined conditions.

6.   A method according to claim 5, wherein the predetermined conditions comprise the detection of at least P consecutive unacceptable relationships, or the performance of at least Q updating steps within R performances of the verification or authentication process.

7.   A method according to claim 6, wherein P is 4, Q is 3 and R is 32.

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8.   A method according to any of the preceeding claims,
wherein the biometric data define a fingerprint.

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I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int.Cl. 5   G07C9/00 ;   G06K9/20

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
Int.Cl. 5	G07C ; A61B ; G06K ; G07D

Documentation Searched other than Minimum Documentation
to the Extent that such Documents are Included in the Fields Searched[8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category[o]	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No.[13]
A	IBM TECHNICAL DISCLOSURE BULLETIN. vol. 21, no. 1, June 1978, NEW YORK US pages 424 - 425; ANTHONY e.a.: "Supervised adaption for signature verification system" see the whole document ---	1-3
A	US,A,4451929 (YOSHIDA) 29 May 1984 see column 1, line 41 - column 3, line 21 see column 4, lines 17 - 55; figures ---	1-3
A	US,A,4724542 (WILLIFORD) 09 February 1988 see abstract; claims 1-8; figures ---	1-3
A	GB,A,2087548 (OMRON TATEISI) 26 May 1982 see abstract; claims 1-9; figures --- -/--	1

° Special categories of cited documents : [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
28 FEBRUARY 1991	19. 03. 91

International Searching Authority	Signature of Authorized Officer
EUROPEAN PATENT OFFICE	MEYL D.

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
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A	EP,A,0075728 (SIEMENS) 06 April 1983 ---	
A	DE,A,2840716 (SIEMENS) 27 March 1980 ---	
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ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO.

PCT/GB 90/01830

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
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